

HYDRAULICALLY DYNAMIC MONO-PIG SCRAPER

FIELD OF THE INVENTION

[0001] The invention relates to a pig scraper for cleaning a coating agent conduit of a coating unit.

BACKGROUND OF THE INVENTION

[0002] In modern coating units for the series coating of construction parts, pig scrapers are used in order to remove coating agent from coating agent conduits. Coating agent residues, which stick to the inside wall of coating agent conduits, must be removed after coating operations. For example, the coating unit can be a paint unit for an automotive assembly line. A first set of automotive parts can be painted a first color by the coating unit. A second set of automotive parts can be painted a second color by the coating unit after the pig scraper has removed the first paint residue from the coating agent conduits of the coating unit.

[0003] A pig scraper is disclosed in EP 0405075B1, which consists of a basic body which can be inserted into a coating agent conduit. The basic body includes a sealing lip which essentially extends radially from the basic body and is located on a jacket surface of the basic body. During operation, the sealing lip fits tightly against the inside wall of the coating agent conduit to be cleaned. The pig scraper scrapes off coating residue sticking to the inside wall of the coating agent conduit and this way builds up an axial isolation path.

[0004] One disadvantage of pig scrapers currently known in the art is that the sealing lip can fold over in the axial direction of the body of the pig scraper when the direction of movement of the pig scraper is changed. When the lip of the pig scraper folds over, a portion of the lip is subjected to excessive deformation forces. As a result, the life of the pig scraper is shortened.

SUMMARY OF INVENTION

[0005] The present invention provides a pig scraper for cleaning a coating agent conduit. The pig scraper includes a body that is insertable in the coating agent conduit. At least one sealing lip extends from the body that is substantially parallel to a longitudinal axis of the body. The sealing lip seals against the coating agent conduit. The body and the sealing lip are integrally formed with respect to one another. For example, the pig scraper can be cast or molded from a water lacquer resistant material or a solvent resistant material. The pig scraper can also include a signal transmitter positioned in situ with respect to the body. The signal transmitter can be a permanent magnet or steel.

[0006] One of the advantages of the present invention is that the sealing lip is substantially prevented from folding over on itself. The sealing lip can be formed with several features that reduce the likelihood that the lip will fold over on itself. For example, the lip can extend a first distance parallel to the body and a second distance radially from the body, wherein the radial distance is ten percent of the axial distance. In addition, the first distance can be six percent of the length of the body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0008] Figure 1 is a cross-sectional view of a pig scraper according to the exemplary embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0009] Referring now to Figure 1, the invention provides a pig scraper 10 for cleaning a coating agent conduit 12 of a coating unit. The pig scraper 10 includes a body 14 having a length and a longitudinal axis 16. The pig scraper 10 also includes at least one sealing lip 18 extending from the body 14 and substantially parallel to the longitudinal axis 16 of the body 14.

[0010] The body 14 extends between first and second ends 20, 22. As shown by the exemplary embodiment of the invention, the body 14 defines three coaxial cylindrical portions 24, 26, 28 having diameters 30, 32, 34, respectively. One of the diameters 30, 32, 34 is preferably 80% of an inside diameter 36 of the conduit 12. More preferably, the minimum of the diameters 30, 32, 34 of the body 14 is 80% of the diameter 36. The body 14 is formed from an elastomer that is preferably water resistant and/or solvent resistant. The body 14 can be molded or cast.

[0011] Preferably, the body 14 and the lip 18 are integrally formed with respect to one another. In the exemplary embodiment of the invention, the lip 18 extends from the portion 26 to a tip 38. Preferably, a free length of the lip 18 extending from the portion 26 to the tip 38 is at least 15% of the diameter 36 of the conduit 12. Alternatively, or additionally, the free length of the lip 18 is six percent of the length of

the body 14. The end 20 of the body is axially further from the portion 26 than the tip to act as a stop buffer. The stop buffer defined by the end 20 reduces the likelihood of damage to the sealing lip 18 in the event the scraper 10 encounters a second scraper in the conduit 12 or a stop.

[0012] In the exemplary embodiment of the invention, a sealing edge 40 extends from the sealing lip 18 radially outwardly with respect to the axis 16. Preferably, the height of the edge 40, as measured from an outer surface 42 of the lip 18, is at most ten percent of the free length of the lip 18. The height of the edge 40 depends on the rigidity of the material used for the sealing lip, the material strength, and the friction between the edge 40 and the inside wall of the conduit 12. For example, the height is relatively greater when the rigidity of the material is relatively greater.

[0013] The sealing edge 40 encircles the lip 18 and seals against the inner wall of the conduit 12. In the exemplary embodiment of the invention, the sealing edge 40 includes a first surface 44 facing the first end 20 of the body 14. Preferably, the surface 44 defines an angle with the inner wall of the conduit 12 of between twenty-five degrees and sixty-five degrees. More preferably, the angle between the surface 44 and the inner wall of the conduit 12 is forty-five degrees. The sealing edge 40 also includes a second surface 46. Preferably, the second surface 46 defines an angle with the inner wall of the conduit 12 of between ten degrees and sixty degrees. More preferably, the angle defined between the second surface 46 and the inner wall of the conduit 12 is thirty degrees.

[0014] In the exemplary embodiment of the invention, the pig scraper 10 includes a second sealing lip 48 structured similarly with respect to the first sealing lip 18. The lips 18, 48 cooperate with the portions 24, 28 respectively, to define first and second pockets 50, 52. The relative structure of the lips 18, 48 with respect to the body

14 can reduce the likelihood that the sealing lips 18, 48 will fold over during movement of the pig scraper 10 through the conduit 12. For example, during movement of the pig scraper 10 in the direction 54, the lip 18 is pressed against the inside wall of the conduit 12 by pressure of the motive medium, such as compressed air, acting on the pocket 50. Also, the sealing lip 48 is pressed against the inside wall of the conduit 12 during movement in the direction 54 by friction acting between the lip 48 and the inside wall of the conduit 12. Similarly, when the pig scraper 10 moves in the direction 56, the sealing lip 48 is pressed against the inside wall of the conduit 12 by the motive medium and the sealing lip 18 is pressed against the inside wall of the conduit 12 by frictional forces.

[0015] In a preferred embodiment of the invention, a signal transmitter 58 is located in the body 14. The signal transmitter 58 is a permanent magnet, a steel core, or another permanent-magnetic material. During operation of the pig scraper 10, the position of the pig scraper 10 can be monitored by monitoring the position of the signal transmitter 58. Preferably, the body 14 is formed around the signal transmitter 58. In other words, the signal transmitter 58 is positioned in situ with the body 14.

[0016] In a preferred embodiment of the invention, the body 14 defines a visible and palpable marking 60, in the form of an elevation, to indicate the spatial orientation of the signal transmitter 58 within the body 14. In this way, the pig scraper 10 can be inserted into the conduit 12 in a desired orientation.

[0017] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The invention may be practiced otherwise than as specifically described within the scope of the appended claims. In addition, the reference numerals in the claims are merely for convenience and are not to be read in any way as limiting.